ARI Research Note 97-31

Individual Feedback Propensities and Their Effects on Motivation, Training Success, and Performance

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Research and Advanced Concepts Office
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September 1997

United States Army
Research Institute for the Behavioral and Social Sciences

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction of the Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Director

Research accomplished under contract
for the Department of the Army

Georgia Institute of Technology

Technical review by

Joseph Psotka

REPORT DOCUMENTATION PAGE

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED (from. . . to)
1997, September	Final	June 1992-June 1997

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Individual Feedback Propensities and Their Effects on Motivation, Training Success, and Performance	MDA903-92-K-0107
	5b. PROGRAM ELEMENT NUMBER 0601102A
6. AUTHOR(S)	5c. PROJECT NUMBER B74F
David M. Herold, Charles K. Parsons, and Donald B. Fedor (Georgia Institute of Technology)	5d. TASK NUMBER 2901
	5e. WORK UNIT NUMBER C10

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
School of Management Georgia Institute of Technology 755 Ferst Street Atlanta, GA 30332-0520	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. MONITOR ACRONYM
U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: PERI-BR 5001 Eisenhower Avenue Alexandria, VA 22333-5600	ARI
	11. MONITOR REPORT NUMBER Research Note 97-31

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

COR: Michael Drillings

14. ABSTRACT *(Maximum 200 words)*:

This research project had as its goal the development, validation, and field testing of new measures of individual differences that assess people's propensities to seek, generate, or interpret performance feedback information in a particular way. Specifically, based on preliminary work, it was thought that internal and external propensities exist that make individuals more or less likely to prefer, rely on, seek, or attend to primarily internally or externally generated performance cues. These propensities, if identified and measured, would be related to skill acquisition, performance improvement, self-regulatory processes, performance maintenance, as well as a variety of affective and cognitive responses to performance settings based on the interaction of the performer's feedback predispositions and the characteristics of the feedback available. In summary, this study proposed to help one better understand the role of dispositions in explaining how different individuals go about shaping their feedback environment, processing feedback information, and responding to such information. The driving belief behind this line of research has been that individuals differ in ways that are specific to their orientation toward performance feedback situations, and that such differences, if identified and appropriately measured, would be valuable in better understanding the links between feedback and performance as well as other outcomes of interest (e.g., feedback-seeking, satisfaction, etc.)..

15. SUBJECT TERMS

Feedback Motivation Internal vs external propensity Internal ability Performance

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	62	

INDIVIDUAL FEEDBACK PROPENSITIES AND THEIR EFFECTS ON MOTIVATION, TRAINING SUCCESS, AND PERFORMANCE

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This research project had as its goals the development, validation, and field testing of new measures of individual differences which assess people's propensities to seek, generate, or interpret performance feedback information in a particular way. Specifically, based on preliminary work, it was thought that internal and external propensities exist which make individuals more or less likely to prefer, rely on, seek, or attend to primarily internally or externally generated performance cues. These propensities, if identified and measured, should be related to skill acquisition, performance improvement, self-regulatory processes, performance maintenance, as well as a variety of affective and cognitive responses to performance settings based on the interaction of the performer's feedback predispositions and the characteristics of the feedback available.

If individual differences in feedback propensities influence the shaping, processing and responding to one's feedback environment, then there are several important applications to which we can apply such understanding. For example, some tasks or jobs are inherently richer in the feedback environment which they provide, and thus may be better matched to the proclivities of some performers than others. Some training methods rely more on self-learning than others, yet individuals may differ in their ability to benefit from the nature of the feedback provided by self-paced instruction, computer-based instruction, or simulator training. Some individuals may need supplemental feedback in

order to acquire new skills or improve their performance in a given situation, while others may perform well with the available feedback. Some individuals may be better able to self-generate feedback on an ongoing basis and thus be better able to operate in environments which rely on self-assessments and self-correction than their counterparts who seek or desire external feedback which may not be available. Some situations, such as training simulators, may be redesigned so as to provide different feedback (e.g., process only, outcome only, or both) to different performers based on what they might best utilize. Finally, it may be possible to train, induce, or otherwise enhance self-monitoring behaviors which lead to heightened abilities to self-assess and self-regulate performance.

In summary, we wanted to better understand the role of predispositions in explaining how different individuals go about shaping their feedback environment, processing feedback information, and responding to such information. The driving belief behind this line of research has been that individuals differ in ways that are specific to their orientation toward performance feedback situations, and that such differences, if identified and appropriately measured, would be valuable in better understanding the links between feedback and performance as well as other outcomes of interest (e.g. feedback-seeking, satisfaction, etc.).

Background and phases of research program

The most obvious way in which people may differ in how they interact with their environment for performance feedback purposes would seem to be along some internal-external orientation dimension. Certainly our personal experiences suggest that some people seem "to be able to figure things out for themselves," while others seem "clueless." Some people seem to need considerably more external confirmation of their performance than others. Some people welcome and even seek others' assessments of their performance, while others disdain or avoid such assessments. Some people seem devastated by others' negative assessments of their performance, while others shrug it off

or welcome it because they perceive it as valuable. Some people critically evaluate the outcomes of their efforts, while others seem to pass it off without much thought. Some people are "hard on themselves" when it comes to self-assessments of performance, while others seem naively optimistic about what they have achieved. Some people seem introspective and can tell exactly where and why their performance may have deviated from a standard, while others need to have it pointed out to them. Some trainees seem to hang on every work uttered by an instructor while others seem to tune out instruction and go their own way. Some students can't wait to get their grades, others seem blasé or disinterested.

Not only is this internal vs. external orientation distinction based on everyday observations, but it is also consistent with the fact that when individual differences have been found to make a difference in feedback research, many of them seem to relate to relative confidence in internal vs. external capabilities, causalities, or merit (e.g., self-esteem, self-efficacy, locus of control). Finally, the external-internal distinction has been previously used in the feedback literature to distinguish between feedback sources in work settings (Greller & Herold, 1975; Hanser & Muchinsky, 1978; Herold & Greller, 1977; Herold & Parsons, 1985). Based on the theoretical, empirical, and practical appeal of this distinction as the most obvious one to pursue, our earlier research focused on whether one or more individual difference dimensions could be identified which would characterize people's seeking of, reliance on, or preference for either internally or externally mediated feedback. Based on encouraging results from our early work (e.g., Herold & Parsons, 1985; Herold, Parsons, & Rensvold, 1991; Parsons & Herold, 1986), we proposed a research program to pursue the development, refinement, construct validation, and field testing of measures which capture these individual differences.

The research program can be divided roughly into three parts or phases, with some overlap between activities across phases (each phase corresponded roughly to Year 1, Year 2, and Year 3 tasks in the original proposal). In Phase I, we focused on literature review,

instrument development, and construct validation of our early measures of feedback propensities. In Phase II we focused on laboratory and field studies to demonstrate the utility of the new measures in explaining outcomes of interest. Also in Phase II, we engaged in a major effort to revise and update our measures based on theoretical and psychometric considerations. In Phase III we focused on a major field demonstration of the utility of our measures in explaining behavior in an applied setting.

Since Phase I and II work has been extensively described in earlier interim reports, this report will only summarize that work. The bulk of the report will focus on the final development work on the measures and on the field demonstration of their utility.

PHASE I

This phase focused on literature reviews of related areas (e.g., self-efficacy, self-esteem, performance feedback, feedback seeking, etc.) and on the initial phases of the development and construct validity of measures intended to reflect internal or external predispositions toward performance feedback. Specifically, three independent dimensions or predispositions were identified empirically and confirmed, using confirmatory factor analysis, on two, widely different independent samples. The three dimensions were: *External Propensity* reflecting the preference for externally mediated feedback as well as greater faith in such information than that which one can self-generate; *Internal Propensity* which reflects the opposite preference but also suggests the tendency to reconcile differences between internal and external feedback in the direction of the internally generated information; and, *Internal Ability* which seems to distinguish between the mere preference for internal feedback and the perceived ability to accurately generate such feedback.

Various activities aimed at supporting the construct validity and demonstrating the potential utility of the new measures were also conducted. Using a sample of military helicopter pilot trainees, we found theoretically consistent relationship between the three

scales and need for achievement, self-esteem and tolerance for ambiguity, while showing their relative independence from another frequently used internal-external construct, locus of control. Using the same sample, we demonstrated that *External Propensity* was related to both the seeking of feedback from instructors and "monitoring" one's environment for feedback clues, while *Internal Propensity* was *negatively* related to instructors assessments of students' performance during early phases of the training. This was interpreted as suggesting that internal reliance on one's own feedback early during training may, in fact, be detrimental to learning.

Several computerized-task laboratory studies were also conducted during this phase, examining the seeking of process and/or outcome information on the part of different individuals. Results showed that for novel tasks, both *Internal* and *External Propensity* were positively related to the seeking of outcome feedback, while *Internal Propensity* was *negatively* related to the seeking of process feedback.

PHASE II

This phase of the research focused on a series of small studies aimed at investigating the utility of our dimensions for explaining behaviors and attitudes under various task feedback conditions. During this time we also initiated a major effort at revisiting the conceptual clarity of our scales by developing a theoretically-based typology of possible dimensions which our three dimensions might be tapping, writing new items to reflect those dimensions not adequately covered by the existing scales, and analyzing the total set of items (new and old) to investigate the stability of our dimensions, better ascertaining their meaning, and identifying any new scales or subscales which reflect aspects of the domain of all possible items which were not tapped by the original dimensions.

Empirical findings

Several studies aimed at better understanding the utility of our measures were reported in our earlier interim reports. In one study we investigated the seeking of process and outcome feedback in a computer-based experimental task. Results showed that our *Internal Propensity* measure was associated with very little seeking behavior under conditions of high task familiarity, but with high levels of seeking under conditions of low task familiarity. This finding suggests that "internals" will seek information when they lack the internal standards to self-assess, but will stop doing so when they feel that they are familiar with the task. Furthermore, we found an effect for social presence, such that higher levels of *Internal Propensity* were associated with the lowest levels of feedback seeking *from the computer* when an experimenter was in the room, whereas those low in *Internal Propensity* sought the highest levels of feedback in the same condition. These results suggest that social cues may inhibit feedback seeking on the part of those who are more internally reliant for feedback.

In another study, using an Army marksmanship simulation, we found that under conditions of blocked simulator feedback, those high in *Internal Propensity* did significantly better than their counterparts early in the training, but seemed to lose interest in the task when denied the opportunity to confirm their performance via some feedback. Under the usual, computer-mediated feedback, those "high" in *Internal Ability* performed significantly better than their "low" counterparts. Finally, we created a constrained social feedback condition in which an experimenter conveyed only the information which the computer would have conveyed, and found that "high" *External Propensity* subjects, while starting out the same as their "low" counterparts, performed progressively worse as the experiment continued. We interpreted this result as indicating frustration at being in a setting where a feedback agent was available but would not interact with the subject other than in a very impersonal, low information way.

In general, these studies, as well as several other field and lab studies spanning several years, provided strong encouragement. We found the individual differences in feedback styles or propensities, as measured by our scales, can be meaningfully assessed, and that these assessments make a difference in various learning and performance situations.

Scale refinements

Based on the series of studies we had done, we were encouraged by the prospects for being able to reliably assess these individual differences and demonstrate their utility in explaining a variety of person-situation interactions in feedback-relevant settings. Before proceeding further, we embarked on a re-examination of the feedback propensities constructs, trying to balance our earlier inductive approach with a more deductive effort aimed at making sure that the domain of possible feedback items was adequately sampled and that the three dimensions did not reflect omissions attributable to the original pool of items.

In order to do that, we took each of the three dimensions (*External Propensity, Internal Propensity,* and *Internal Ability*) and further dimensionalized them according to two well-established dimensions along which feedback is thought to vary, whether it is positive or negative, and whether it refers to outcomes or to process, and crossed the four resulting categories with whether the item reflected a feedback-relevant cognition, an attitude, or a behavior. This resulted in twelve categories of feedback items into which the original items from each scale were divided, and a new item-writing effort was initiated to identify items which would reflect each cell which was not represented or under-represented.

The resulting items were administered to 404 undergraduate and graduate students for the purpose of identifying underlying factors. We found that the original *External Propensity* dimension, which consisted of items expressing a preference for externally-

mediated feedback when such was expected to be largely neutral or positive in nature, remained intact, but that parallel items written to reflect the valuing of negative external feedback formed their own factor, including items which reflected the purposeful seeking of external feedback even if one expects it to be negative. This yielded two external propensity scales: *External Propensity -- neutral/positive, and External Propensity -- negative.*

The original *Internal Feedback Propensity* dimension it will be recalled reflected a tendency for self-feedback to dominate information from external sources. This dimension again remained intact, but a new set of internal items formed a dimension which reflects feedback of a self-congratulatory type when performance warrants it; we termed this dimension *Self-Reinforcement Propensity.*

Finally, the original *Internal Feedback Ability* dimension reflecting one's belief that he/she can figure things out for themselves, or accurately generate their own feedback also remained intact, but new items formed an additional dimension which seems to reflect one's confidence in one's ability to self-assess without the aid of feedback from others -- we called this dimension *Internal Feedback Confidence.* All scales had adequate internal consistencies (alphas ranging from .68 to .84 with only *Internal Feedback Confidence* being below .70). An examination of their relationship with self-esteem, tolerance for ambiguity, need for achievement and locus of control showed them to be theoretically consistent, but not redundant with other commonly used measures of individual differences (Parsons, Herold, Fedor, Rensvold, Goodman & Davis, 1994).

PHASE III

For this phase we set out to conduct a large-scale field study in which the utility of our measures could be studied under "real world" conditions in which feedback was being provided as part of a regular routine designed for training purposes. Since this would be the final phase of a prolonged exploratory research program, it was desirable to study people in controlled feedback conditions. While one may lose something in generalizability of findings to settings where feedback may vary by source, by type (e.g., outcome vs. feedback), or by other features (e.g., timing, sign, specificity, etc.), it was felt that getting a sounder understanding of person-situation interactions in a limited, yet not contrived setting was worth it. Toward that end, we sought a field site in which we could clearly identify the performance feedback available and study people's utilization of, and reactions to that feedback. It was also thought that periods of skill acquisition might be most appropriate for studying people's reliance on, or utilization of various feedback available in their environment. The identification of a private flight academy, and their utilization of a standardized, computer-based flight simulation as an integral part of their training, met these criteria.

The study took place at the COMAIR aviation training facility where student pilots receive flight training and flight certifications. Students at this facility participate in orientation, simulator training, ground school, and in-flight cockpit training. Upon entering the training program, students participate in an orientation session which outlines basic training procedures. Students then spend approximately one to two weeks training on a *Basic Flight Instruction Tutorial System* (BFITS). This simulator provides: (1) basic instruction on principles of flight (e.g. aerodynamics) and (2) practice in a simulated cockpit setting. Following successful completion of BFITS training, students either enter ground school or move into in-flight cockpit training with an instructor pilot.

The BFITS simulator is a PC-based flight training system consisting of 31 lessons requiring about 50 hours to complete on average (Benton, Corriveau, Koonce, & Tirre,

1992). BFITS combines a tutorial that teaches the declarative knowledge (facts, definitions, concepts) with a procedural trainer that teaches the procedural knowledge (cognitive and motor skills) needed to perform basic flight maneuvers in a simulated general aviation aircraft. Following the basic flight principles segment (declarative knowledge), the first phase of flight simulation in BFITS training teaches basic procedures, including climb, straight and level flight, descent, and turns. Subsequent phases go into more complex maneuvers which make use of the basic procedures. Trials to mastery for each of the maneuvers are recorded as measures of performance.

During the simulation no outside feedback of any type is provided. Instructors have not yet been assigned to the students, and other than questions concerning the operation of the hardware and software, which can be directed to the lab administrator, no sources of information are available to the student while performing. The computer provides no process feedback, but only lets students know when they've exceeded any lesson's parameters, causing a failure and the need to repeat that lesson. The computer-provided feedback can probably be characterized as negative for the vast majority of students. This is because most BFITS lessons are complex enough such that multiple errors are committed and multiple trials are required to pass a lesson. While formal feedback is not available beyond that which the computer provides, students probably do discuss their simulator experience with others, students and/or academy staff, outside the formal training setting. This feedback, however, needed to be sought out by the students and had to be informal in nature since the feedback providers were not privy to the actual performance. To the degree that such feedback seeking went on, it provided an opportunity for us to study whether of such behavior related to our feedback propensities.

With the cooperation of COMAIR, we had access to 15 entering classes of approximately 20 students each, over a period of 15 months. On the first day of orientation we would hold a group administration of our questionnaires containing the individual differences measures, various other measures of general attitudes, expectations concerning

the training, and demographics. BFITS training would commence immediately after orientation. Subsequent to the completion of BFITS, the lab coordinator would place a post-BFITS questionnaire in students' mailboxes, encouraging them to return these to him/her in sealed envelopes for transmission to the research team. The post-BFITS questionnaire contained measures of attitudinal and behavioral reactions to the simulator experience. Students were informed that their participation was totally voluntary and that their individual data would be treated in strictest confidence and would not be shared with the academy, or anyone else. Student identification numbers were provided by the students to enable us to link various data collection efforts over time.

After students completed their flight instruction phase, culminating in the granting of a private pilot's license, we had access to their flight records for the purpose of obtaining data concerning the number of hours it took for them to successfully complete the certificate training. Not all students entering the academy were in the private pilot phase. Those in more advanced phases, such as instruments, multi-engine, etc. were followed for the pre- and post-BFITS data in order to study any differences attributable to flight experience. For the private pilot students we obtained data from their flight records on the hours it took them to complete the course. Since the advanced students split into many different programs, of varied length, and the cohorts were relatively small, we did not track them beyond their reactions to the simulator (which was required of all students regardless of their flight experience). This procedure, coupled with normal and expected attrition at the various data collection points (e.g., failure to return questionnaires), plus the elimination of students from foreign countries who were having obvious language difficulties, created a sample of 181 for whom we have pre- and post-BFITS data, and 86 students for whom we have both sets of BFITS data, as well as flight performance data.

Measures

An initial survey was administered to participants during the orientation session. This survey assessed demographic information and individual differences in feedback-related propensities. The full version of these scales appear in Appendix 1. All items used a 5 point agree-disagree response scale.

INTERNAL FEEDBACK ABILITY - A 10 item scale (internal consistency alpha = .85) measured participants' perceptions of their ability to accurately generate their own feedback. Sample items from this scale include: "When I finish something, I can usually tell right away whether I did it well or not" and "If I make a mistake while working, I can usually sense it immediately".

INTERNAL FEEDBACK CONFIDENCE - A 5 item scale (alpha = .64) measured participants' confidence in their ability to assess their own performance without the aid of feedback from others. Sample items from this scale include: "When others' opinions about my work are different than my own, I tend to question my own judgment" and "I find that I am not very good at assessing my own performance and need to rely on the inputs of others" (both reversed scored).

INTERNAL FEEDBACK PROPENSITY - A 5 item scale (alpha = .73) measured the extent to which participants value their own assessments more than the feedback of others, and reconciled contradictory feedback in favor of one's self. Sample items from this scale include: "How other people view my work is not as important as how I view my own work" and "As long as I think I have done something well, I am not too concerned about how other people think I have done".

PROPENSITY TO SELF-REINFORCE - A 5 item scale (alpha = .76) measured the extent to which participants tended to reflect on positive performance experiences. Sample items from this scale include: "I tend to give myself a pat on the back for a job well done" and "I like to step back and reflect on a job well done".

EXTERNAL FEEDBACK PROPENSITY (POSITIVE/NEUTRAL) -A 6 item scale (alpha = .71) measured the extent to which participants tended to value feedback from other people. Sample items include: "It is very important for me to know what people think of my work" and "I like being told how well I am doing on a project".

EXTERNAL PROPENSITY FOR NEGATIVE FEEDBACK- A 4 item scale (alpha = .77) measured the extent to which participants tended to seek out and value negative feedback from other people. Sample items include: "I seek out reactions to my work even if I think they might be negative" and "I seek others' assistance in figuring out how to improve my performance".

A second survey was administered after each participant completed BFITS. On this survey we assessed a set of participant reactions to BFITS. These scales also appear in Appendix 1.

FEEDBACK SEEKING - A 7 item scale (alpha= .74) assessed the extent to which participants sought information from other people during their BFITS training experience. Sample items include: "I asked for help from other BFITS trainees" and "I talked to others (including individuals not doing BFITS) about the usefulness of BFITS".

FEEDBACK DESIRE - A 3 item scale (alpha = .74) assessed the extent to which the participant would have liked more feedback from external sources during BFITS training. Sample items include: "I wished I had someone working with me to provide additional help" and "I would have liked for someone to periodically review my progress".

INSTRUMENTALITY - A 4 item scale (alpha = .93) that assessed the belief that BFITS would be beneficial in flight training. Sample items include: "BFITS helped me identify potential weaknesses in my flight skills" and "BFITS will make me a better pilot".

STRESS - A 3 item scale (alpha = .60) assessed the degree to which the participant felt frustrated and stressed during BFITS training. Sample items include "I found BFITS flight lessons to be frustrating" and "I felt stress while going through flight lessons".

Along with the demographic variables, individual difference measures, and BFITS reactions collected through surveys, performance measures were collected during both simulator and in-flight training.

SIMULATOR PERFORMANCE - The number of trials subjects took to successfully perform all of the BFITS flight maneuvers lessons was used as the measure of simulator performance.

IN-FLIGHT TRAINING PERFORMANCE - In-flight performance was defined as the number of in-flight hours it took to complete certification for the Private Pilot

license. In-flight training time was recorded in the participants' training record by the students' instructor pilot

Our results will be presented as follows. Following a description of the sample and overall relationships among the variables, we will present our primary results from in two sections. In the first section, we will focus on simulator performance, reactions, and attitudes based on the post-simulator data. The next section will focus on the private pilot students and relationships between their pre- and post-simulator data and actual performance in the cockpit.

Table 1 shows the means and standard deviations from the demographic variables and other variables of interest in this study. The average age of the participants was 26.3 years and 93% were male. In terms of previous flight experience, about 24% had no flight experience, 6% had some, but less that 15 hours, and 52% had a private license. This latter group was excluded from analysis concerning the impact of our individual differences on time to private. Additionally, flight experience was a control variable in the other analyses. The average number of trials required to complete BFITS was 350.

Insert Table 1 about here

Table 2 shows the correlations among the individual difference variables, BFITS performance, time to private pilot license (TMPRIV), previous flight experience (FLTEXP), and various reactions to the BFITS simulator. The correlation between BFITS performance and time to private is .51. Those students who performed well in simulator training tended to perform well during in-flight training.

Insert Table 2 about here

Table 2 also shows the correlation between the individual differences and BFITS performance and time to private license. For BFITS performance, we see that there is a statistically significant negative correlation with *Internal Feedback Confidence*, indicating that people with such confidence take fewer trials to complete BFITS. Interestingly, there is also a significant positive correlation between *Internal Feedback Confidence* and previous flight experience. It is unclear why such an association should exist unless the internal feedback confidence scale was completed by new trainees with the aviation task in mind. In this case it would make sense that people with flight experience would feel more confident in the feedback they might generate during performance of aviation-related skills.

There were no significant correlations between the individual difference variables and time to private license. The impact of the feedback propensity variables may be in their interaction with performance feedback. This will be explored later.

In Table 2, there are also some statistically significant correlations between various reactions to BFITS and the individual difference variables, especially *External Feedback Propensity*. These relationships are better analyzed using multiple regression which will follow shortly.

Finally, we are also interested in the intercorrelations of the individual difference variables themselves. Because these scales are relatively new, we are still looking at evidence concerning their properties such as intercorrelations. In the current sample, the correlations range from -.12 to .46, supporting the idea that they are somewhat independent dimensions. Additionally, their internal consistencies continue to be satisfactory (ranging from .64 to .85, See Appendix 1).

Simulator results

In order to understand the unique effects of flight experience, BFITS performance and individual differences on various outcome measures, we used hierarchical multiple regression. For each regression, in step 1 flight experience was entered. In step 2, BFITS

performance was entered. In step 3, each of the six feedback-related individual difference measures was entered. Step 4 examined possible interactions between BFITS performance and individual differences. In the final step, we conserved degrees of freedom by using a forward entry procedure for the six interaction terms. In forward entry, each variable in the block of variables is considered one at a time for entry into the equation. At each step, the variable with the smallest probability of F is entered. This process continues until none of the remaining variables makes a significant contribution to the regression equation. The above procedure was followed except for the multiple regression for BFITS performance where step 2 was eliminated because BFITS was the dependent variable.

BFITS Performance. As shown in Table 3, performance on BFITS was predicted by the students' level of flight experience, Internal Feedback Confidence (INFBCON), and Internal Feedback Propensity (INFBPR). Flight experience accounted for 17 percent of the variance and the propensities, in total, accounted for an additional 5 percent. For this outcome, there were no interactions tested.

Insert Table 3 about here

The results indicate that flight experience was negatively related to the number of trials it took the students to complete BFITS. Stated another way, the more prior flight experience the students had the better they did in the BFITS simulator. This finding provides some validation for the BFITS simulator. However, flight experience accounted for less variance in BFITS performance than might be expected. This may be due to a number of factors. First, flight experience beyond a certain level might not constitute any additional advantage or that one might need to reach a certain level of experience before one gains any advantage on the simulator. An inspection of the mean performance levels for the five different levels used to categorize flight experience suggests that the latter

explanation appears to receive some support. Those with over 15 hours of flight training seem to perform much better than those with less flight experience.

Second, given that BFITS is a PC-based training system, the skills necessary for good performance are not going to perfectly match those that contribute to successful cockpit performance. Third, former flight training might, at least partially, interfere with learning from BFITS. The advance students already "know" how to fly and revisiting the basic flight skills on BFITS may have required some relearning or unlearning to perform well. Finally, we heard from the students that there were some frustrating lessons in BFITS. This might have been particularly so for the students with significant flight experience. Therefore, the experienced students may have had to deal with stronger emotions than the less experienced students. Some indirect support for this last notion can be drawn from the fact that experience level was negatively related to seeing BFITS as instrumental in learning actual flight-related skills. This finding is discussed in greater detail below.

Two of the individual differences also made significant contributions to predicting BFITS performance even after experience level was taken into account. Those who reported higher confidence in their ability to self generate performance feedback (*Internal Feedback Confidence*) did better than those who reported low confidence in this ability. Possible explanations for this finding are that those high on this individual difference were: 1) less frustrated by the simulator feedback which tended to be negative because of confidence in their own feedback, 2) better able to develop their own cues and strategies for effectively using the available feedback, or 3) more effective in generating accurate process feedback for themselves and thus able to self correct more readily. Overall, it does appear that those high on *Internal Feedback Confidence* were better able to make the external cues more useful.

In contrast, those high on Internal Feedback Propensity (INFBPR) encountered more difficulties in BFITS than those low on this individual difference. This finding is

consistent with previous results in another flight training situation reported earlier to the Army Research Institute. It appears that the higher individuals score on INFBPR the less likely they are to utilize feedback other than their own. Therefore, they either overly filter corrective feedback or they might feel they are doing fine even when other, more veridical sources indicate they are not.

Desire For Feedback. Table 4 shows the multiple regression of flight experience, BFITS performance, and the individual differences on Feedback Desire. Flight experience clearly makes a difference in how much additional feedback and help individuals want. The variance accounted for is 14 % and the regression weight is negative indicating that those with more flight experience were less interested in additional feedback. In contrast, poorer performance in BFITS was associated with a greater desire for feedback. This variable accounted for an additional 5.7% of the variance in feedback desire. Among the individual difference variables, the block of 6 variables accounted for a statistically significant 7.2% of additional variance. *External Feedback Propensity* had a significant regression weight with higher scores associated with greater desire for feedback. There were no significant interactions between BFITS performance and the individual differences.

Insert Table 4 about here

Therefore, we have found evidence that in the feedback environment that existed for the BFITS simulator, there is a statistical reliable effect for the individual difference that is most logically associated with desiring more external feedback (*External Feedback Propensity*). This is further evidence that there is a disposition towards wanting external feedback and it plays a role in who wants such feedback several weeks into a training program. This is especially important when considering that many training simulators are

designed to be feedback rich environments, but only from a single source, the simulator itself. An identifiable subset of trainees desires more and the training organization may be able to design the feedback environment to better accommodate these needs.

Feedback Seeking. Self reported feedback seeking during BFITS training was significantly related to prior flight experience and two of the individual differences (see Table 5). In addition, the desire for feedback was included as a final step in the analysis. Flight experience accounted for just over 7 percent of the variance and the propensities, in total, accounted for an additional 8 percent. For this outcome, there were no significant interactions. The desire for feedback was marginally significant (.07) and contributed approximately 2 percent additional variance.

Insert Table 5 about here

The more flight experience the students had the less they reported engaging in feedback seeking. This finding is not surprising given that they probably had less need for feedback and they might have felt more foolish asking for it. This is consistent with Ashford's work that has pointed to the resource value of feedback as well as the costs involved in obtaining it (Ashford, 1986).

The fact that *External Feedback Propensity* (EXFBPR) was positively related to feedback seeking is also to be expected. Those who value external feedback more also reported taking steps to get more of it. Somewhat surprisingly, we found that *Internal Feedback Confidence* (INFBCON) also had a significant positive regression weight. We suspect that in the early stages of performing a new, challenging task, people who are high on this characteristic tend to seek out others for feedback about the expectations for and requirements of the task. That is, they want to understand the "rules of the game." This

information is necessary for establishing the internal standards that allows the person to self-generate accurate internal feedback.

Instrumentality of BFITS. Table 6 shows the multiple regression of perceived instrumentality of BFITS on flight experience, BFITS performance, and the individual differences. Flight experience had a statistically significant association with perceived instrumentality, accounting for 5.8% of the variance. The negative regression weight indicates that those with more previous flight experience perceived BFITS to be less instrumental (or useful) to them. Interestingly, the next variable, BFITS performance, was not related to perceived instrumentality, after controlling for previous flight experience. In Table 2, it had shown a statistically significant, positive zero-order correlation ($r = .17$). Thus, differences in BFITS performance do not appear to have an influence on the perceived usefulness of BFITS. This suggests that perceived usefulness is not a function of how well a person did in BFITS.

Insert Table 6 about here

Of the individual difference variables, we see that *External Feedback Propensity* again has a significant effect on perceived instrumentality suggesting that people who like external feedback may have seen the extensive feedback from BFITS as valuable. But more interesting is the interaction between BFITS performance and *External Feedback Propensity* which accounts for an additional 5.7% of the variance in perceived instrumentality. This interaction is described by Figure 1.

Insert Figure 1 about here

Of the group that performed more poorly on BFITS (e.g. more trials to completion), it appears that higher levels of *External Feedback Propensity* leads to perceptions of greater instrumentality. There is no difference in instrumentality perceptions for good performers. Individuals who are high in *External Feedback Propensity* may not be as bothered by the negative feedback from the larger number of trials and continue to see value in BFITS as contrasted to individuals who have a lower *External Feedback Propensity*. An additional plausible explanation is that the high *External Feedback Propensity* individuals seek feedback beyond that provided by the BFITS program. They appear to consult with instructors or classmates and this additional feedback helps them keep their BFITS performance in perspective. This explanation is supported by the earlier described relationship between *External Feedback Propensity* and feedback seeking.

This finding is important because it points out that the individual difference variable seems to have its effect for poorly performing individuals. From a motivational perspective, it is important that these individuals continue to see value in using the simulator. Otherwise it becomes an exercise to be completed with little reason to focus on actually learning from it. Therefore, it is these poorly performing individuals for whom we tend to target training interventions. Because *External Feedback Propensity* plays a role in the instrumentality belief for poor performers, this further suggests that the training organization must continue to provide feedback opportunities from other people such that high external propensity individuals can obtain such feedback. On the other hand, it also suggests that the training organization must be more proactive in dealing with the low External Propensity individuals. They are less likely to voluntarily choose to avail themselves of existing external feedback opportunities. Nor is it as certain that they will see the value in requiring them to engage in such feedback sessions. More will be said about this after further results are presented.

Stress Experienced During BFITS. BFITS performance was the only main effect that approached significance ($p < .09$). There were no main effects for the individual differences. However, reported stress was related to an interaction between *Internal Feedback Propensity* and BFITS performance which accounted for 7.4 percent of the variance. These results are shown in Table 7 and the interaction in Figure 2.

Insert Table 7 and Figure 2 about here

The finding that stress is the outcome of an interaction between a situation, in this case BFITS performance, and an individual difference is consistent with the literature on stress that has noted that it is how individuals react to situations that produce (or result in) the experience of stress. So while doing poorly on BFITS was somewhat related to stress, the real finding is in the interaction.

In this case, those students who tended to reconcile feedback differences in favor of their own internal feedback (i.e., high on *Internal Feedback Propensity*) reported a moderate level of stress regardless of their BFITS performance level. In contrast, the stress reported by those low on this individual difference was directly related to BFITS performance. For those who did well on BFITS, their stress level was the lowest reported, while those who did poorly reported the highest level of stress. It would appear that those in this latter group tended to see poor BFITS performance as significantly more threatening than those who looked more internally for how they were doing when there were differences between their own and BFITS-based feedback. Performing poorly on BFITS would have produced a great deal of negative, outcome feedback. Those high in INFBPR seemed to be buffered, at least somewhat, from finding this to be a very stressful situation.

Flight Performance Results

Up to this point, we have focused on results related to the BFITS training simulator. Participant performance and reactions to the simulator appear to be related to several of the feedback-related propensities. Next, we will describe the results for the in-flight training, specifically the number of hours it took to satisfy the requirements for the private pilot's license.

Time To Private Pilot's License. Time to private (TMPRVT) was significantly related to BFITS performance and an interaction between BFITS performance and External Feedback Propensity (EXFBPR). The BFITS main effect accounted for 24.3 percent of the variance and the interaction contributed another 5.1 percent. The results are shown on Table 8 and the interaction is depicted on Figure 3.

Insert Table 8 and Figure 3 about here

It should be noted that the results for time to private are based solely on the students who had little or no flight experience, thus reducing the sample size to 86 and this is why flight experience was not included in this analysis. However, even on this reduced sample, the results for BFITS are very encouraging. Performance on BFITS was directly related to how long it took the students to earn their private pilot license. Therefore, finding ways to help students perform better on the simulator can translate into better cockpit performance.

The interaction between BFITS and *External Feedback Propensity* points to a problem for those who performed poorly on BFITS and were less externally oriented. It appears that somehow those high on EXFBPR were better able to reduce the negative impact of "failure" on BFITS. Results reported above provide a hint as to why these findings occurred. It was previously shown that feedback seeking was positively related to

both BFITS performance and EXFBPR. As such, it appears that those high on EXFBPR and who were having trouble were more likely to get additional feedback from others. If we assume that some of the feedback they received would have provided comparative feedback, these students would have seen that they were not the only ones running into problems and could have derived support from such comparisons. Also, it is likely that those from whom they sought feedback may have provided direct encouragement as well. This "outside" information may have helped the students to put their difficulties into a more positive and useful perspective.

The effects of early simulator performance. Finally, we investigated whether or not the above findings concerning the interaction of individual differences and BFITS performance could be identified earlier on in training. If the trends of certain people who perform poorly on BFITS and will ultimately perform poorly in the cockpit (relative to others) could be identified earlier, it would suggest that early identification and possible interventions may allow us to better tailor training to these trainees. Since the first 4 lessons of the simulator concerned basic flight maneuvers (e.g., climbs and turns), we computed a "Phase I BFITS performance", BFITS1, measure consisting of the total trials to criterion for these early lessons and repeated the above analysis.

We found that trials to criterion in the basic procedure phase of BFITS was positively related to hours to private pilot license ($r = .33$; $p < .01$ compared to $r = .51$ for total BFITS performance). Thus, those students who performed well early in simulator training tended to perform well during in-flight training.

As in the previous analyses, we conducted a hierarchical multiple regression of TMPRVT on BFITS1 and the individual difference variables. Table 9 reports the results of this analysis. In step 1, BFITS1 performance was a significant predictor of in-flight performance. BFITS1 performance explained 17.3% of the variance in time to private. In

the next step of the analysis, the six individual differences did not explain a significant increment in time to private.

Insert Table 9 about here

Finally, in step three of the analysis, the interaction of *Propensity to Self Reinforce* and BFITS performance entered as a significant predictor of in-flight performance ($p < .05$) and explained an additional 4.6 % of the variance. Figure 4 shows a graph of this interaction. For persons who have a high *Propensity to Self Reinforce* their performance experiences, there is no relationship between BFITS performance and flight performance. However, for those low in this individual difference, there is a strong relationship between BFITS performance and flight performance. Thus, those with a low *Propensity to Self-Reinforce* who perform poorly on the simulator also performed poorly during in-flight training. However, when those with a low *Propensity to Self-Reinforce* performed well on the simulator, they also did well during in-flight training.

Insert Figure 4 about here

Probably the most important finding in the analysis of early BFITS performance and the individual differences was the sizable interaction between Propensity to Self-Reinforce and performance on time to private. In the introduction to this phase we suggested that excessive trials in the simulator are likely to be interpreted as negative feedback by the trainee. With no instructor present to offer encouraging words, the poor performing trainee may experience dysfunctional stress, negative thoughts, frustration, and other distracting emotions that if no counteracted, significantly reduce learning during these trials. For the person who has a propensity to self-reinforce, they are providing a counteracting force to the negative feedback from the simulator, which may enable them to

maintain higher levels of concentration and confidence which facilitate learning. Much as the *External Feedback Propensity* may be important for obtaining the support and perspective from other people during BFITS, the *Propensity to Self-Reinforce* helps the trainee remained focused during early lessons.

Discussion of field study results

In order to organize the many results derived from the field study phase of our research, a summary has been prepared and is shown in Table 10. Overall, it can be seen that of the six feedback-related individual differences that were developed and tested, four of them were significant predictors of the outcomes investigated with the COMAIR Aviation Academy flight students. These result occurred after flight experience and BFITS performance were already taken into account. *Internal Feedback Confidence*, *Internal Feedback Propensity* , and *External Feedback Propensity* were significant main effects, with the latter two propensities also interacting with BFITS performance. *Self-Reinforcement* was the one individual difference that was only significant as part of an interaction.

Insert Table 10 about here

The number of significant relationships found for the individual differences is extremely encouraging and points to the important role of how individuals respond to performance feedback, especially in a training setting. It is also worth noting that with six outcomes investigated (Time to Private was tested twice - in relation to total BFITS performance and then with performance in the first phase of BFITS), three of the individual differences were involved in four interactions. This provides support for the expectation that the individual differences will often not show up as simple main effects, but that their real power is revealed in relation to things like current and past performance.

Within this setting, *External Feedback Propensity* was the most consistent predictor of reactions to BFITS. It was positively related to the desire for external feedback, feedback seeking, and perceived instrumentality of BFITS. These findings are consistent with other research we have conducted wherein those who reported wanting

more feedback have taken steps to acquire it. Therefore, it is not surprising that in this setting, where there was no formal external feedback, those high on *External Feedback Propensity* reported desiring external feedback and acquiring external feedback on their own.

Furthermore, *External Feedback Propensity* had a significant main effect and interacted with BFITS performance to predict instrumentality perceptions. This is the first time that we have investigated instrumentality in relation to the feedback-related individual differences. These results point not only to a greater acceptance of training by those externally oriented, but also that this may motivate them to exert greater effort in learning from BFITS. Moreover, *External Feedback Propensity* interacted with BFITS performance to predict time to private pilot's license. In this case, those high in this propensity and who had difficulty in BFITS were better able to use the BFITS experience in improving their cockpit performance.

Internal Feedback Confidence was negatively related to BFITS performance (i.e., the higher the confidence, the better the performance) and feedback seeking (the higher the confidence, the more feedback seeking). The first finding was anticipated, but the second one was not. Normally, those who are self-confident in their feedback generating abilities would not be expected to do feedback seeking. However, given the training setting, we understand this finding to represent a need for information with which to build appropriate evaluation standards. Therefore, those who are high on *Internal Feedback Confidence* will take steps to be able to self-evaluate when necessary.

Internal Feedback Propensity was positively related to BFITS performance (i.e., the higher the propensity, the poorer the performance). As noted earlier, this has been found in a previous training setting. Those who prefer their own internal feedback, especially when it differs from external feedback, may block out valuable information. In addition, *Internal Feedback Propensity* interacted with BFITS performance to predict stress. In this case, an internal feedback orientation helped reduce the experience of stress

when faced with performance difficulties. As such, *Internal Feedback Propensity* appears to be a "two edged sword" that can help reduce stress, but also reduce learning during training.

Self-Reinforcement was not a significant main effect for any of the outcomes tested, but did interact with the first phase of BFITS performance to predict time to the private pilot's license. In this case, those who are high on this individual difference were better able to learn from BFITS even when encountering performance difficulties.

As previously noted, two of the feedback-related individual differences, *Internal Feedback Ability* and *External Feedback Propensity -Negative* did not play significant roles in this study. However, this does not suggest that they should be dropped from further consideration. We recognize that this study was performed in a very particular training situation. While simulators are becoming more and more common, it is still not the most prevalent way to train people. A simulator is only one type of source for performance information. There were no external sources providing negative feedback as part of the training and the sources sought out by the student pilots most likely provided either process, comparative, or positive feedback. In such a setting it is not surprising that *External Feedback Propensity -Negative* was not related to reactions or performance.

Apparently, one's *Internal Feedback Ability* also was not relevant in this situation. However, if the training setting was significantly different, or a non-training setting was used, the set of feedback-related individual differences that function as predictors could change significantly. The fact that four of the six were shown in this study to add significantly to our explanatory power of important outcomes is noteworthy and an excellent based point from which to further our knowledge of these feedback-related individual differences.

SUMMARY AND CONCLUSIONS

This program of research was proposed in order to explore the intersection of two important concepts thought to affect human performance, especially in learning, training, or skill-acquisition settings, namely, performance feedback and individual differences in generating, processing or reacting to such feedback. While there exists an extensive literature on the nature and beneficial effects of performance feedback, little is known about how particular individuals react to, or shape their feedback environment. The thrust of our program has been to identify and assess a unique set of individual differences which characterize how people interact with their feedback environment. We call this a domain-specific approach to individual differences because global assessments have not been as potent as one might have hoped for in identifying person-situation interactions which are so important for understanding human performance.

By domain-specific, we mean explicitly making a fidelity-bandwidth tradeoff, such that we accept lower cross-situational predictive power in return for better understanding behaviors in a narrower set of situations, i.e., situations in which performance feedback is thought to be important for self-regulation, performance improvement, and/or motivation. Building on everyday experiences that people obviously differ in their proclivities toward seeking feedback, valuing it, accepting it, or even providing it to themselves, plus some of our earlier research findings which suggested that such proclivities could be assessed in terms of external or internal orientations toward feedback, we set out to demonstrate two things: a) that a set of feedback-related individual differences could be identified, and sound measures of these developed; and b) that such differences relate to performance-related phenomena in a systematic and potentially important manner.

Through a series of field and lab studies, as well as extensive psychometric work, we identified six dimensions along which individuals can vary in their feedback propensities. We showed that the various distinctions are more complicated than just a

single, bi-polar dimension of internal-external. We showed that internal orientations toward performance feedback can be dimensionalized according to the tendency to value internal feedback, the tendency to self-reinforce one's self for performance, the ability to self-assess, and the confidence one has in one's self assessments. We showed that external orientations toward performance feedback could be distinguished in terms of whether one values feedback one expects to be largely neutral or positive, or whether one values external feedback even if it is negative.

We engaged in a variety of construct validation attempts with both the originally-proposed 3-dimension scheme and the subsequently developed 6-dimension scheme. In all cases we showed that our measures are theoretically consistent with other measures of individual differences, but not redundant with them. We also showed, in a variety of settings, and using widely different methodologies and populations that our measures are associated with differential performance under different feedback conditions, as well as with attitudinal and cognitive reactions to feedback situations. For example, we found that external orientation to feedback explained people's seeking of feedback from peers and supervisors; we found that internal propensities were related to task mastery in a training session where not much feedback was available to the trainee; we found differences in the asking for process and outcome feedback when learning a novel task; we found differences in trainees assessments of their instructor based on the trainees' feedback orientations.

While the above could be construed as things we learned through a series of exploratory studies aimed at pinning down some of the measures and demonstrating their utility in various settings, our final field demonstration was intended to be a much more comprehensive test of the potential applications of this work. The field demonstration may be said to be the final phase of exploratory research. We have developed sufficient understanding of the behavior and application of our measures to allow us, and others to move to hypothesis-testing research. This field demonstration also bridged our more basic research with important applications which might make use of our work.

Several important points should be noted about this final phase of our work. First, we were able to demonstrate important differences in people's response to a real-world training situation in which the nature and amount of feedback was directly based on the design of the training protocol and the performance of the trainee. Second, we found differences between types of people for a variety of attitudinal measures, self-descriptions of behavior, as well as actual performance. Third, all responses, attitudinal, self-descriptive behaviors and performance were temporally removed from the assessment of the individual differences, thus systematic relationships are not likely to be a methodological artifact. Fourth, our performance measures were "hard" measures, independently obtained, and of great importance to the individuals and the organization. Specifically, differences in many hours of training required to achieve a given level of proficiency, when such training costs $120/hour, not to mention motivational and scheduling problems which occur when performance is sub-par, are clearly significant. Fifth, our measures of individual differences were shown to be potent predictors of behavior, even when competed against traditionally strong predictors such as similar past performance.

Finally, in a true demonstration of interactionist perspectives on human behavior, person-situation interactions were repeatedly found in our research. This last point strongly supports the move toward domain-specific measures of individual differences. If one specifies the domain and theoretically develops conceptualizations of what kinds of individual differences are likely to be evoked by such domains, one is likely to make more progress than either assuming that situations are all powerful and variances in behavior are random, or, investigating individual differences which do not theoretically map onto the situations being studied. Statistical interactions of the type we have found, in terms of both their consistency and variance explained are relatively unique in social science. Thus, we hope that we have made a contribution not just to the understanding of performance

feedback phenomena, but also to demonstrating alternative ways of pursuing individual differences research.

In terms of implications for the future, we believe that we have identified many potentially important areas which may be investigated based on our foundation. Briefly, we will illustrate some of these implications. Our research has implications for the design of training programs so that feedback provided or made available may be better matched to the needs of the individual trainee. This may be especially important in feedback-constrained situations, such as simulators or self-paced instruction. In these situations we may eventually be able to augment the currently available feedback through redesign of the technology or the addition of alternative sources of feedback such as instructors. We may also be able to create feedback "menus," such that individuals may seek feedback (e.g., outcome only, or process) which better suits their learning habits.

While we do not want, at this point, to promote our work as having organizational selection implications, it may not be too early to investigate job assignment or placement implications. Certain jobs or assignments, by their nature, have more or less inherent feedback, of varying quality or ambiguity, available to performers. Conceivably, our predispositions may be useful in predicting who will prosper or flounder in these different types of situations. Another application of our research, supported by our examination of the early simulator performance of trainees, may be in monitoring the performance of trainees for early signs of difficulties. Our research suggests that some individuals will be more handicapped by early poor performance during training than others.

Finally, our research opens the possibility that self-assessment and self-regulation, so important for the mastery and maintenance of many behaviors in organizations, may be, to some degree, trainable. If individuals could be trained to self-assess on a particular task, have their confidence built that such assessments are veridical, and develop the ability to self-reinforce both the act of self-assessment and their performance, we may be able to achieve levels of self-regulated, self-improving, and self-maintaining performance we so

want in many situations. Unfortunately, many of our current training procedures, trying as they are to minimize time and resources to achieve proficiency, may be substituting short-term criterion attainment for long term performance maintenance.

In summary, we believe that we have accomplished everything we set out to accomplish. In the true spirit of programmatic research, we have cumulatively built upon our various research efforts to arrive at some interesting, and potentially important conclusions about person variables associated with performance feedback. Our work has been well accepted by the scientific community in terms of journal publications, book chapters, and scientific presentations, and we foresee several important contributions still coming from this research. This research has also engaged a variety of doctoral students, with at least three dissertations having been influenced by this work. Hopefully this will lead to a propagation of efforts which will speed up the accumulation of knowledge in this area.

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propensities. Paper presented at the 1994 annual meeting of the American Psychological Society., Washington D.C.

SCIENTIFIC CONTRIBUTIONS AND DISSEMINATION OF RESEARCH

Publications

Herold, D.M., & Fedor, D. (1998). Individual Differences in Self-Regulatory Behaviors. To appear in Ferris, G. (Ed.) *Research in Personnel and Human Resource Management*, Volume 16.

Herold, D.M., Parsons, C.K., & Rensvold, R.B. (1996). Individual Differences in the Generation and Processing of Performance Feedback. *Journal of Educational and Psychological Measurement., 56*, 5-25.

Other top tier publications are anticipated based on the results from the field study described in this report and revision of presentation papers noted below.

Presentations

Herold, D.M., & Parsons, C.K. (1994). Individual differences in feedback propensities and the effectiveness of computer-based learning. Paper presented at Computers in Psychology '94 Conference, York, England, Sept. 22, 1994.

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Rensvold, R.B. (1993). Individual and contextual antecedents of perceived feedback-seeking cost in aviation training: A longitudinal study. Best Paper Proceedings of the Academy of Management Annual Meeting.

Doctoral Students whose Dissertations resulted from this research program

Roger Rensvold who is now at City University of Hong Kong

Jodi Goodman who is now at Purdue University

Walter Davis who is currently working on dissertation based on the COMAIR research

Table 1
Descriptive Statistics For All Study Variables and Sample Demographics

Variable	Mean	Standard Deviation
AGE	26.3	5.66
SEX	. 07	.26
FLTEXP	2.79	1.76
INFBAB	3.98	.47
INFBCON	3.56	.61
SELFRE	3.78	.57
INFBPR	3.72	.62
EXFBPR	3.88	.54
EXPBNE	3.99	.58
BFITS1	74.22	57.83
BFITS	350.41	206.68

Legend

AGE - Student's Age Upon Entering COMAIR
SEX - Student's Sex (Coded 0 = Male, 1 = Female)
FLTEXP-Flight Experience
INFBAB - Internal Feedback Ability
INFBCON - Internal Feedback Confidence
SELFRE - Propensity to Self-Reinforce
INFBPR - Internal Feedback Propensity
EXFBPR - External Feedback Propensity
EXFBNE - External Propensity for Neg. Feedback
BFITS1 - Total Number of Trials to Complete the First of Four Flight Segments
BFITS - Total Number of Trials to Complete All BFITS lessons

Table 2
Intercorrelations For Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. BFITS													
2. PRIV	.51**												
3. FLTEXP	-.40**	-.16											
4. FBDESIRE	.37**	.19	-.35**										
5. FBSEEK	.19*	.11	-.27**	.31**									
6. INSTR	.17*	.21	-.27**	.23**	-.01								
7. STRESS	.15*	.03	-.03	.23**	.25**	-.11							
8. INFBAB	-.01	-.15	.01	.11	-.01	.00	.04						
9. INFBCON	-.18*	-.13	.21**	-.16*	.02	-.08	-.07	.43**					
10.INFBPR	.14	.15	-.02	.11	.05	.04	.10	.28**	.26**				
11. SELFRE	.04	.07	.07	.19*	.02	.10	.01	.37**	.05	.13*			
12. EXFBPR	.11	.04	-.07	.22**	.21**	.19*	.03	.19**	-.12	.00	.30**		
13. EXFBNE	.07	.05	.00	.13	.13	.08	.00	.29**	.06	.16**	.28**	.46**	

n= 86 to 293

** $p < .01$
* $p < .05$

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
FLTEXP = previous flight experience
FBDESIRE = Desire for feedback
FBSEEK = Reported feedback seeking behavior
INSTR = Perceived instrumentality of BFITS simulator
STRESS = stress experienced during BFITS
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 3
Regression Results for Predicting BFITS Performance

Predictors	Beta	R^2	R^2 Change
Step 1			
FLTEXP	-.41	.170	.170
Step 2			
INFBAB	ns		
INFBCON	-.16		
SELFRE	ns		
INFBPR	.17		
EXFBPR	ns		
EXPBNE	ns		
		.220	.050

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 4
Regression Results for Predicting Feedback Desire

Predictors	Beta	R^2	R^2 Change
Step 1			
FLTEXP	-.37	.140	.140
Step 2			
BFITS	.28	.198	.057
Step 3			
INFBAB	ns		
INFBCON	ns		
SELFRE	ns		
INFBPR	ns		
EXFBPR	.17		
EXFBNE	ns		
		.270	.072

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 5
Regression Results for Predicting Feedback Seeking

Predictors	Beta	R^2	R^2 Change
Step 1			
FLTEXP	-.27	.074	.074
Step 2			
BFITS	ns	.079	.005
Step 3			
INFBAB	ns		
INFBCON	.23		
SELFRE	ns		
INFBPR	ns		
EXFBPR	.22		
EXFBNE	ns	.162	.083
Step 4			
Interactions	ns		
Step 5			
FBDESIRE	.16 (.07)	.182	.019

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback
FBDESIRE= Desire for Feedback During BFITS

Table 6
Regression Results for Predicting Instrumentality

Predictors	Beta	R^2	R^2 Change
Step 1			
FLTEXP	-.24		
		.058	.058
Step 2			
BFITS	ns		
		.063	.006
Step 3			
INFBAB	ns		
INFBCON	ns		
SELFRE	ns		
INFBPR	ns		
EXFBPR	.20		
EXFBNE	ns		
		.108	.045
Step 4			
EXFBPR x BFITS	1.83		
		.165	.057

Legend

BFITS = total number of trials in BFITS simulator
FLTEXP = Flight Experience
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 7
Regression Results for Predicting Stress
Experienced During BFITS

Predictors	Beta	R^2	R^2 Change
Step 1			
FLTEXP	ns	.00	.00
Step 2			
BFITS	ns	.019	.019
Step 3			
INFBAB	ns		
INFBCON	ns		
SELFRE	ns		
INFBPR	ns		
EXFBPR	ns		
EXFBNE	ns	.034	.014
Step 4			
BFITS X INFBPR	-2.25	.108	.074

Legend

BFITS = total number of trials in BFITS simulator
FLTEXP = Flight Experience
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 8
Regression Results for Predicting
Time to Private Pilot's License

Predictors	Beta	R^2	R^2 Change
Step 1			
BFITS	.49	.243	.243
Step 2			
INFBAB	ns		
INFBCON	ns		
SELFRE	ns		
INFBPR	ns		
EXFBPR	ns		
EXFBNE	ns	.272	.030
Step 3			
BFITS X EXFBPR	-1.73	.324	.051

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 9
Regression Results for Predicting Time to Private from BFITS 1

Predictors	Beta	R^2	R^2 Change
Step 1			
BFITS 1	.42	.173	.173
Step 3			
INFBAB	ns		
INFBCON	ns		
SELFRE	ns		
INFBPR	ns		
EXFBPR	ns		
EXFBNE	ns	.242	.068
Step 4			
SELFRE x BFITS	-2.32	.288	.046

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

Table 10
Summary of Results

	BFITS	Feedback Desire	Feedback Seeking	Instrument-ality	Stress	Time to Private
FLTEXP	-	-	-	-		NT
BFITS	NT	+				+
BFITS1						+
INFBAB						
INFBCON	-					
SELFRE	+					
EXFBPR		+	+	+		
EXFBNE						
EXFBPR x BFITS				INT		INT
INFBPR x BFITS					INT	
SELFRE x BFITS1						INT

Legend

BFITS = total number of trials in BFITS simulator
TMPRIV = number of hours to complete private pilot license
FLTEXP = previous flight experience (1 = no experience, 2 = , 3= , 4= completed private pilot license
INFBAB = Internal feedback ability
INFBCON = Internal feedback confidence
INFBPR = Internal feedback propensity
SELFRE = Propensity to self-reinforce
EXFBPR = External feedback propensity
EXFBNE = External propensity for negative feedback

NT = Not tested
INT = Interaction

Figure 1

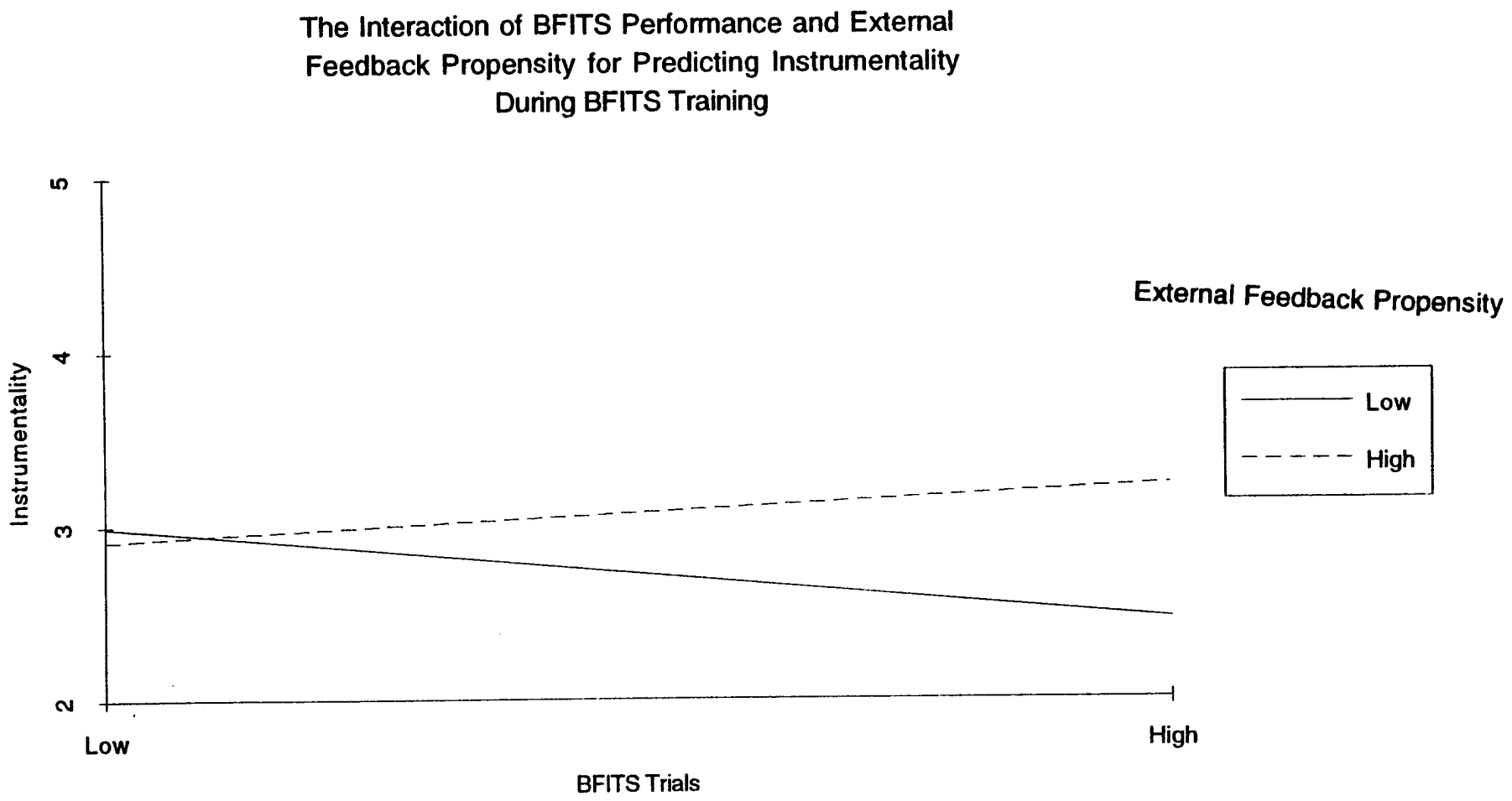

The Interaction of BFITS Performance and External Feedback Propensity for Predicting Instrumentality During BFITS Training
Instrumentality
5
4
3
2
Low
High
BFITS Trials
External Feedback Propensity
Low
High

Figure 2

The Interaction of BFITS Performance and Internal Feedback Propensity for Predicting Stress Experienced During BFITS Training

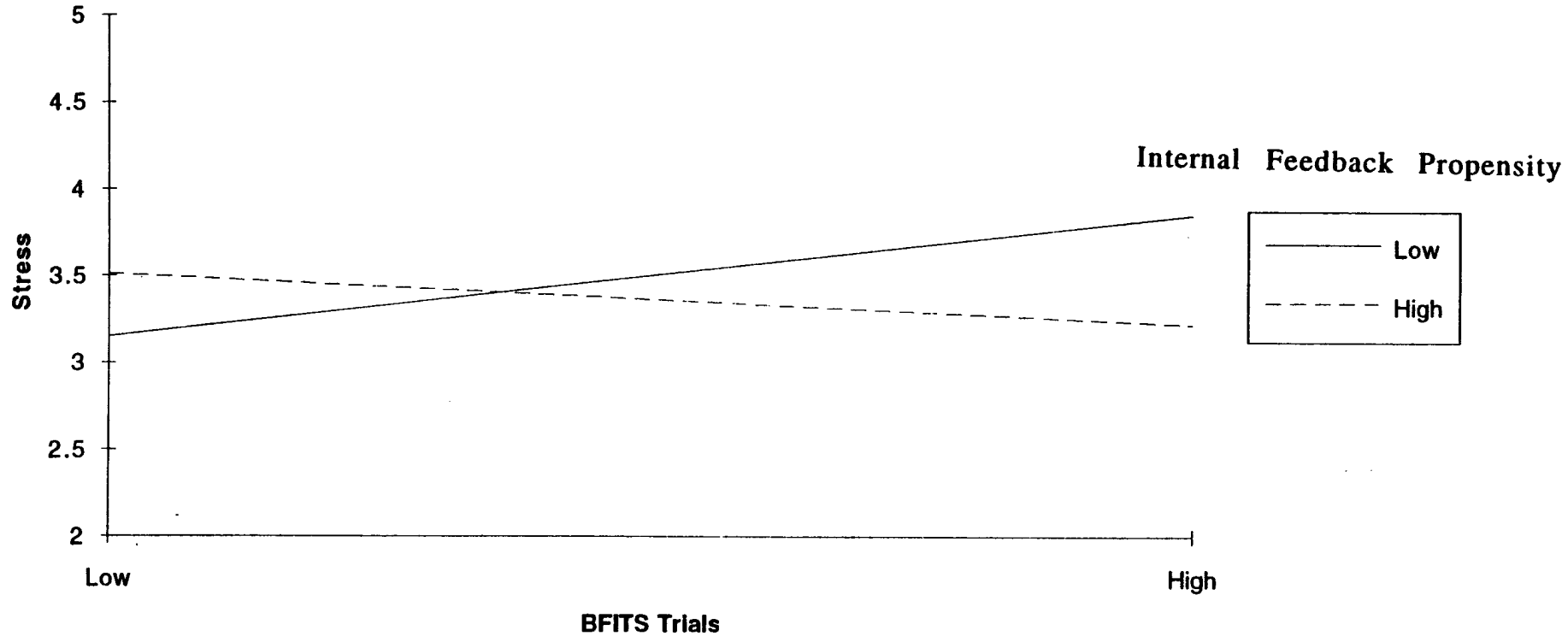


Figure 3

The Interaction of BFITS Performance and External Feedback Propensity on Time to Private Pilot's License

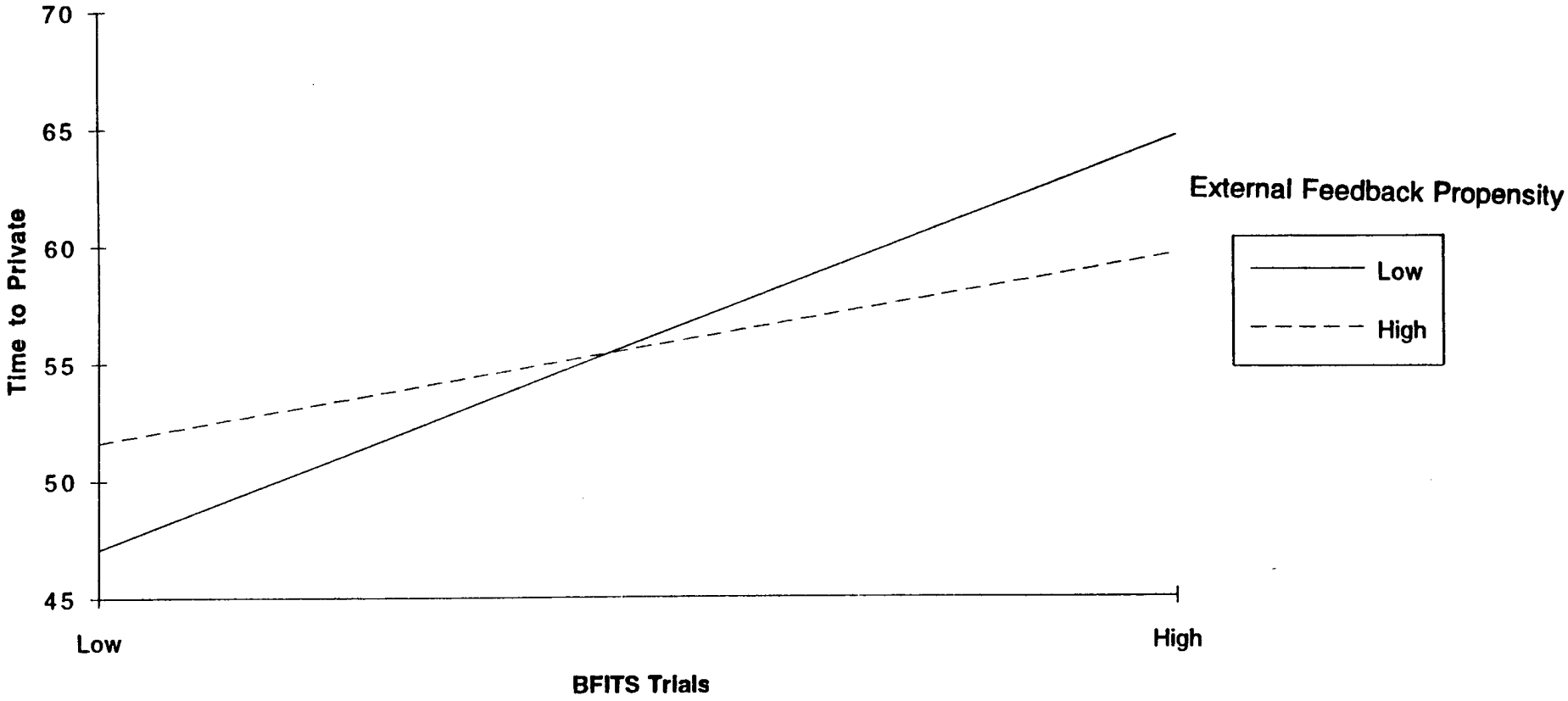
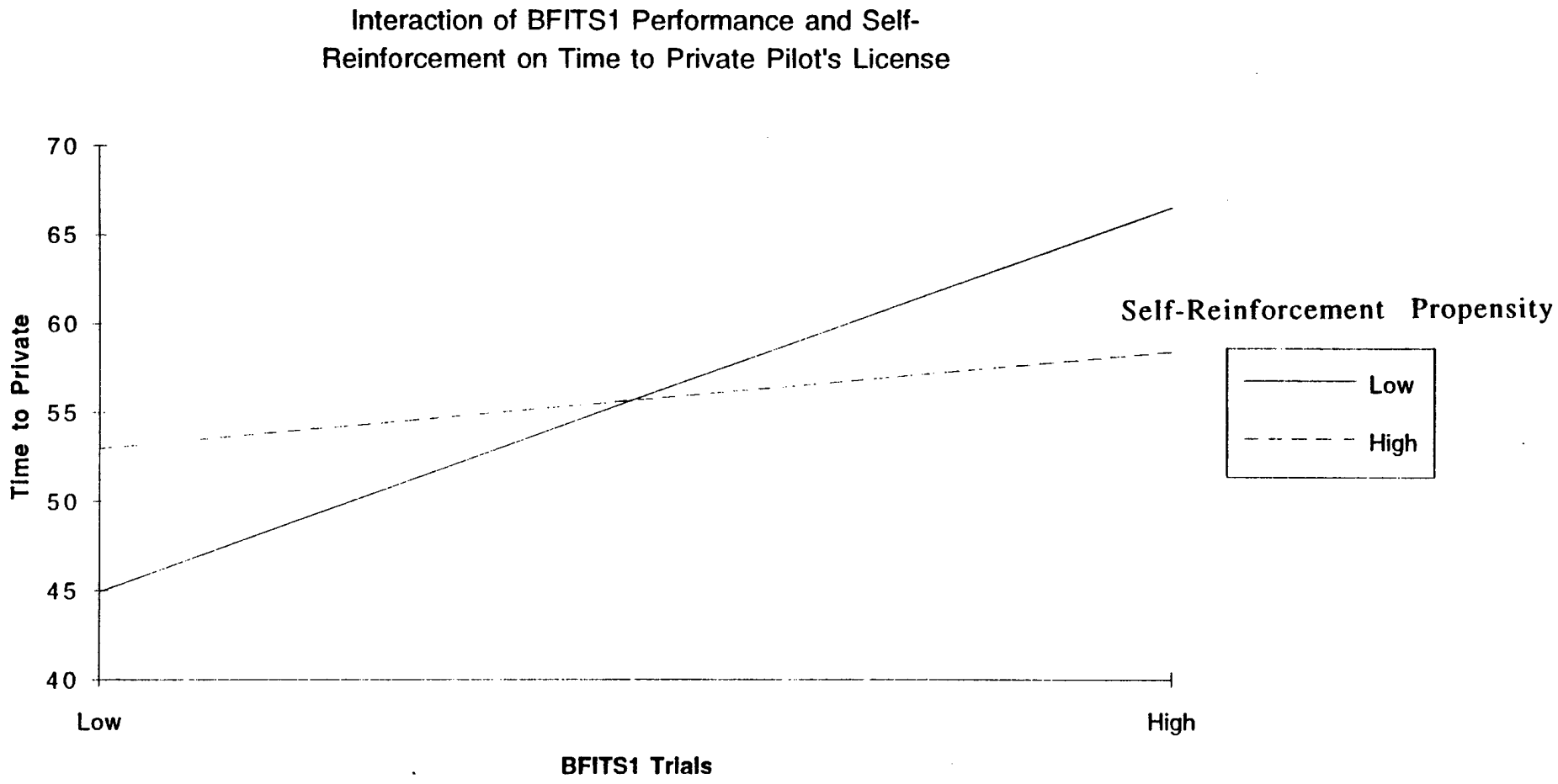


Figure 4


Interaction of BFITS1 Performance and Self-Reinforcement on Time to Private Pilot's License
70
65
60
55
50
45
40
Time to Private
Low
High
BFITS1 Trials
Self-Reinforcement Propensity
Low
High

Appendix 1

Scales and Internal Consistencies

Internal Feedback Ability (alpha = .85)

1. I find that I am usually a pretty good judge of my own performance.

2. When learning a task, I'm pretty good at identifying what parts I have mastered.

3. I usually have a clear idea of what I am trying to do and how well I am proceeding towards my goal.

4. When performing a task, I can usually tell early on if it is going to turn out okay.

5. When I finish something, I can usually tell right away whether I did it well or not.

6. I know when my work is not up to standards before anybody tells me.

7. When I finish something, I can usually tell right away if I did not do it well.

8. If I make a mistake while working, I can usually sense it immediately.

9. I usually know why my performance is slipping.

10. When I have done something well, I know it without other people telling me so.

Internal Feedback Confidence (alpha = .64)

1. I'm often at a loss as to how to improve my performance. (R)

2. When I'm disappointed in my performance, often I don't know what I did wrong. (R)

3. I find that I am not very good at assessing my own performance and need to rely on the inputs of others. (R)

4. Until I hear I've done a good job from someone else, I often don't trust my own impressions. (R)

5. When others' opinions about my work are different than my own, I tend to question my own judgment. (R)

Internal Feedback Propensity (alpha = .73)

1. If you think you have done something well, don't let other people's opinions to the contrary get you down.

2. As long as I think I have done something well, I am not too concerned about how other people think I have done.

3. How other people view my work is not as important as how I view my own work.

4. People ought to be more concerned with their self-image than with what other people think.

5. What I think of myself and my work is more important to me than what others think.

Propensity to Self-Reinforce (alpha = .76)

1. I tend to celebrate my work accomplishments.

2. I tend to give myself a pat on the back for a job well done.

3. After finishing a project that turned out well, I tend to reflect on what went right.

4. I like to step back and reflect on a job well done.

5. After completing a project, I like to spend some extra time reflecting on those things that I did particularly well.

External FeedbackPropensity (alpha = .71)

1. It is very important for me to know what people think of my work.

2. Even though I may think I have done a good job, I feel a lot more confident of it after someone else tells me so.

3. Even when I think that I *could* have done something better, I feel good when other people think well of what I have done.

4. I like getting frequent feedback from others regarding my performance.

5. I like being told how well I am doing on a project.

6.I don't like going for long periods of time without getting feedback concerning my performance.

External Propensity - Negative Feedback (alpha = .77)

1. I like receiving feedback that identifies where my performance has been deficient.

2. I seek out reactions to my work even if I think they might be negative.

3. I look for opportunities to get comments on my work, even if those won't be favorable.

4. I seek other's assistance in figuring out how to improve my performance.

Feedback Seeking (alpha = .84)

1. I talked with other BFITS trainees about any difficulties I encountered.

2. I asked for help from other BFITS trainees.

3. I compared my progress through BFITS lessons with that of other BFITS trainees.

4. I asked others how far along they were with BFITS.

5. I shared my experiences with other BFITS trainees.

6. I compared my BFITS performance (e.g. number of times it took to get through the lessons) with others.

7. I talked with others (including individuals not doing BFITS) about the usefulness of BFITS.

Feedback Desire (alpha = .74)

1. I wished I had someone working with me to provide additional help.

2. I would have liked access to an instructor to help me through specific maneuvers.

3. I would have liked for someone to periodically review my progress on BFITS.

Instrumentality (alpha = .93)

1. I believe that my BFITS experience will be helpful in my flight training.

2. BFITS helped me identify potential weaknesses in my flight skills.

3. BFITS will save me flight lesson time.

4. BFITS will make me a better pilot.

Stress (alpha = .60)

1. I found BFITS flight lessons to be frustrating

2. After the flight lessons on BFITS, it would take me some time to "come down."

3. I felt stress while going through BFITS flight lessons.